Analysis of Baseline Program Data from the Ph.D. Completion Project
Ph.D. Completion and Attrition:
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PH.D. COMPLETION AND ATTRITION:
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from the Ph.D. Completion Project

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FOREWORD
By Debra W. Stewart, CGS President

“Knowing what to measure and how to measure it makes a complicated world much less so. If you learn how to look at data in the right way, you can explain riddles that otherwise might have seemed impossible. Because there is nothing like the sheer power of numbers to scrub away layers of confusion and contradiction [sic].” (Levitt and Dubner, 2005, p. 14)

Doctoral education in the United States is the model for much of the rest of the world. Its strengths are reflected both in the excellent preparation of graduates and the capacity to produce research and researchers who are primary contributors to economic growth and civic engagement. However, these results come at a price. Doctoral education is very expensive, both in financial terms and in terms of the time and effort invested by doctoral students, faculty, and others who sustain the enterprise.

It was the stature and the costliness of the doctoral enterprise that motivated the graduate community in the mid-1990s to launch a self-examination directed at identifying areas of weakness and at generating strategies for addressing them. The result has been a proliferation of studies and reports on doctoral education in the United States. These reports focused on different disciplines, different sub-sets of graduate students, different time frames, and the efficacy of different interventions (Ph.D. Completion and Attrition: Policy, Numbers, Leadership, and Next Steps. Washington, DC: Council of Graduate Schools, 2004). By 2003, it was clear that all of this work provided an enormously rich stew for creative speculation about how doctoral education might be further strengthened, a context that was probably essential for motivating the “jewel in the crown of higher education” to believe that even it could benefit from polishing. It was also clear that the time had come for CGS to launch a national initiative that would result in firming up a foundation for specific best-practice recommendations to U.S. graduate schools, programs, funders, and policy makers.

In order to reach this point, two things had to happen. First, we needed to identify a common empirical measure for assessing positive change. And second, in selecting that mode of measurement, we needed to think about the critical leverage points that could help unpack the mélange of issues that
had emerged in the “rich stew” of discussion and scholarship cited above. We settled on student completion and attrition rates from Ph.D. programs as the key point of leverage to ultimately generate best-practice recommendations to improve the effectiveness of America’s Ph.D. programs.

Completion was the key because we believed that of all of the issues raised in nearly a decade of our self-criticism of doctoral education, the most urgent was that too few students admitted into U.S. doctoral programs actually graduated. We also believed, as Levitt and Dubner note in the quotation introducing this Foreword, that “there is nothing like the sheer power of numbers to scrub away layers of confusion and contradiction.” We hoped that if we could launch a project that would empower all stakeholders, especially the deans of U.S. graduate schools, to lead conversations with faculty and students about what the completion and attrition rates actually were, and about what kinds of interventions might most successfully be implemented to improve completion, that alone would move the conversation forward. But if we could actually study a carefully selected set of interventions, specifically designed to address attrition in clearly defined disciplinary, programmatic, and university settings, we could ultimately generate the information upon which solid best-practice recommendations could be provided by CGS to our membership community. The Ph.D. Completion Project is aiming to achieve that objective.

This book, *Ph.D. Completion and Attrition: Baseline Program Data from the Ph.D. Completion Project*, is the first in a series of monographs that will be forthcoming from the project. Most CGS publications advance best practices in defined fields or, at the very least, describe the current state of discussion regarding best practices in emerging fields. As the first book in our major national demonstration project on Ph.D. completion and attrition, this book is both similar to and different from the typical CGS publication. Most readers familiar with CGS publications will be struck by the fact that this book trades in the currency of numbers rather than the more typical broad policy-statement or curriculum-oriented best-practice document. The book gives more emphasis to presenting data than to interpreting its meaning, though of course we do some of both. It invites more attention to the granularity of charts, tables, and numbers rather than the 10,000-foot-view prose that is our normal trade. But we begin with this level of granularity precisely because we believe that now is the time for action to increase Ph.D. completion, and that this action needs to be based on both a solid empirical understanding of the current situation and a transparent approach to how completion and attrition are calculated. While there is a best-practice element to this monograph, it lies in the elaboration of a methodology for assessing Ph.D. completion and attrition in the fine grain
essential to moving the discussion forward. The CGS completion team headed by Robert Sowell struggled over how far we should go on interpretation of the baseline data and generally came down on the side of less rather than more.

One of the risks of such a hard-hitting data presentation that characterizes trends across student cohorts and fields is that there is a temptation to generalize from these data to the enterprise as a whole. Thus at this very introductory stage we want to be clear as to what these data represent and what they do not. The data displayed here were provided by institutions selected in a national competition that invited graduate schools to record their own history of completion and attrition, craft strategies to address issues, implement those strategies, and measure their impact in part by continued tracking of student completion. Participants were selected for inclusion based on the belief that they were committed to carrying through with these tasks. As it turned out, the project also represents a set of institutions that are broadly representative of doctoral-granting institutions: public and private, large and small, geographically dispersed universities, with reasonably diverse missions regarding doctoral education. Nonetheless, we do not claim this data set to represent the universe of doctorate-granting universities or programs in the U.S. and Canada. The sample is limited in both fields covered and characteristics of institutions participating. But the field coverage does provide good insight into core disciplines as well as into most major broad fields of doctoral study. And the “judgmental sample” does give a window into performance at typical major public and private, geographically dispersed, and large and small institutions. The bias is clearly in the direction of universities and graduate schools tangibly committed to the mission of systematically understanding and acting upon the challenge of increasing completion rates.

Other important data-gathering activities will allow interested parties to consider the universe of research doctoral programs with respect to at least some of the aspects of completion and attrition documented here.¹ But the Ph.D. Completion Project institutions as a whole provide a benchmark against which institutions who equally aspire to measure and then act on their completion and attrition challenges can assess their own performance. We are pleased to share this baseline data as a first step in launching a national, even international, discussion about achieving success in doctoral education.

¹ National Academy of Science, National Research Council, An Assessment of Research-Doctorate Programs, forthcoming.
Many organizations and individuals deserve thanks for their commitment to this project, for supporting it financially and for bringing it to fruition through their labors and their leadership. Let me begin with our funders. First thanks go to Pfizer, Inc., for both its very generous financial support of the infrastructure for the Completion Project and for the specific funding for the entire fields of the sciences, engineering and mathematics. The deep commitment of Pfizer to developing the domestic talent pool in America and to building a global talent pool emerged in the very first conversation we had about increasing completion as a key strategy for success. Their commitment has been sustained throughout. There would be no Completion Project without the leap of faith that the leadership of Pfizer Global Research and Development and Pfizer Corporate Human Resources took with CGS in the early days. Deep thanks also go to the Ford Foundation, whose strong support of the humanities and social sciences allowed us to expand the project to those important fields.

The case that we made to Pfizer and the Ford Foundation was based in part on the dialogue that occurred at an invitational workshop that CGS held in spring 2003 with funding from the Alfred P. Sloan Foundation and the National Science Foundation. Thanks also to both the Sloan Foundation and NSF for this critical early support.

Then in the spring of 2004, as a result of the generous programmatic grants provided by Pfizer and Ford, CGS embarked upon one of the largest and most diverse efforts ever undertaken to address the underlying issues behind student completion of and attrition from Ph.D. programs across the sciences, engineering, mathematics, the social sciences, and the humanities. After reviewing a strong pool of 45 proposals, an external advisory committee selected 21 universities for funding as Research Partners to spearhead this effort. The remaining 24 universities were invited to participate as Project Partners. Shortly before this publication went to press, a strengthened commitment to the project by both Pfizer and Ford has enabled the pool of partnering institutions to grow, with the addition of eight new Research or Data Partners and continued funding to 14 Research Partners from the first phase of the project. It is the great partnership between Pfizer and the Ford Foundation that will continue to sustain the Ph.D. Completion Project through 2010.
Of course, in addition to the funders, we offer our deep thanks to the member universities that are the core partners in this project. We are grateful to all those who have informed and improved this project: the student respondents, the committed faculty, and the graduate deans and senior leaders in graduate education who have served as principal investigators or otherwise supported this important effort. We also acknowledge the good work of the project Advisory Board. To the Advisory Board members, listed in Appendix A, we say thank you for the sound counsel, the thoughtful selection of participants, the willingness to provide periodic advice, and the sustained commitment to reading drafts and offering comment as we begin to publish findings from the initial phase of the project.

Final thanks go to the professional efforts of the CGS staff (and friends) in all phases of this project. At the formative stages of the project I thank Joan Lorden, Les Sims, Carol Lynch, Robert Sowell, Jennifer Slimowitz, and Daniel Denecke for their good efforts and advice as we convened the discussions and developed the proposal to the funders. In the first phase of the project thanks go to Daniel Denecke for his very important program direction and Helen Frasier and Matthew Loveless for their tireless efforts in data collection. And in the current phase of the project, including data analysis, authoring publications, and continuing project leadership, I offer very special thanks to Robert Sowell, the director of the Ph.D. Completion Project, as well as Kenneth Redd, Ting Zhang, and Emily Neubig who have provided their expertise in data collection and analysis and to Lewis Siegel, for his especially helpful ongoing advice and counsel. Like everything at CGS, the volumes emerging from this project are the result of a team effort. But it is only fair to recognize the unique leadership of Robert Sowell and the special and determined labors of the Sowell, Redd, and Zhang team that brought this current publication to fruition.
CHAPTER 1
Introduction

Doctoral education is the “jewel in the crown” of American higher education. Judged by standards of research productivity, quality of education, and alumni success, U.S. research universities have merited highest honors for their doctoral programs. In the area of Ph.D. productivity, however, many graduate students who begin these programs do not complete them. In response to growing national concern about high levels of attrition from doctoral programs, the Council of Graduate Schools (CGS) has developed the Ph.D. Completion Project, a research and demonstration program that examines and documents attrition and completion patterns at a variety of major institutions, develops and models intervention projects, and studies and validates the impact of these interventions upon Ph.D. completion.

In conjunction with this project, CGS published *Ph.D. Completion and Attrition: Policy, Numbers, Leadership and Next Steps* (Council of Graduate Schools) in 2004. This report helped set the agenda for the project. It summarized the current state of knowledge about completion of and attrition from doctoral programs in the U.S. and Canada and described measures that research universities were taking to increase Ph.D. completion rates in North America. This publication developed out of a white paper produced by the Council of Graduate Schools in the summer of 2003.

The current report, the first in a new series, provides an overview of the CGS Ph.D. Completion Project and focuses on the baseline program completion and attrition data from the 30 universities that participated in the first phase (2004-2007) of the project. The data are analyzed by discipline, broad field, cohort size, and institutional type (public or private, non-profit). This is the first of three reports that will present and analyze project baseline data. The two subsequent baseline data reports will focus on: (1) completion and attrition by demographic characteristics and (2) exit surveys collected both from students who complete their programs and from those who do not. Further publications will report on self-assessments and interventions being implemented by the participating institutions and will provide more in-depth analysis of completion and attrition data, including the impact of intervention projects on completion and attrition.
These publications are not intended to serve as best-practice monographs, which CGS generally issues at the conclusion of major grants initiatives. In 2010, CGS will issue such a publication, which will include a comprehensive analysis of the quantitative and qualitative data submitted by the partnering universities in Phases I and II of the Ph.D. Completion Project, as well as a comprehensive description of those policies and practices that appear to have had a demonstrated effect on completion rates and attrition patterns over time. The wide range of institutions participating in the project has been designed to ensure that the findings and practices that emerge will be representative of and applicable to the majority of North American graduate institutions engaged in the doctoral enterprise.

CHAPTER 2
The CGS Completion Project: Context and Overview

The National Context, Including Prior Studies

While there is not complete agreement on the appropriate measurement of doctoral completion or attrition, commentators regularly decry the significant waste of student talent and university resources implied by high doctoral student attrition. Several prior studies (e.g., Bowen & Rudenstine, 1992; Espenshade & Rodriguez, 1997; and Lovitts, 2001) have suggested that close to half of all U.S. doctoral students fail to complete their degrees. It is particularly difficult to accept or even understand such a rate, given that law schools and medical schools typically report completion rates at 95% and above, while some highly selective colleges also typically report undergraduate completion rates of 95%, even for members of underrepresented racial/ethnic minority groups.

Although there have been no nationwide longitudinal studies that cover a large number of universities or disciplines and that calculate completion in a uniform way, smaller studies have reported Ph.D. completion rates ranging from a low of 33.4% (in the humanities and social sciences [Bowen & Rudenstine, 1992]) to a high of 76% (for students in biomedical and behavioral sciences supported on NIH National Research Service Award training grants [Pion, 2001]). Summarized in Table 1 below, these studies suggest that even under highly favorable conditions, no more than three-quarters of the students who enter doctoral programs complete their degrees. They also suggest that completion rates are higher in the Physical and Life Sciences than in the Social Sciences and Humanities, higher for men than for women, higher for majority than for minority students, and higher in smaller than larger doctoral programs. In addition, demographic studies show that completion rates are higher for international students than for students who are U.S. citizens and permanent residents.
Table 1 Summary of Prior Major Studies of Ph.D. Completion and Attrition Patterns

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<th>Author</th>
<th>Institutions</th>
<th>Years Addressed</th>
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<td>Smaller cohorts higher completion than larger</td>
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<td>Completion</td>
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<td>Completion</td>
<td>76%</td>
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<td>Completion</td>
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</tr>
<tr>
<td>Zwick</td>
<td>1978</td>
<td>Completion</td>
<td>13-82%</td>
<td>H &lt; S &lt; N Men higher</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golde [1998]</td>
<td>1980-89</td>
<td>Attrition</td>
<td>11-61%</td>
<td>Public higher attrition than private; no cohort size effect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golde [2005]</td>
<td>1984-89</td>
<td>Attrition</td>
<td>18-37%</td>
<td>H &lt; P &lt; L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lovitts</td>
<td>1982-84</td>
<td>Attrition</td>
<td>33-68%</td>
<td>Integrated students more likely to complete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canadian cohort</td>
<td>1992</td>
<td>Completion</td>
<td>46-74%</td>
<td>H &lt; S &lt; P &lt; L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Research Council of Canada</td>
<td>1970-79</td>
<td>Completion</td>
<td>74%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attiyeh</td>
<td>1989-93</td>
<td>4-yr persistence</td>
<td>30-66% (Avg. 43%)</td>
<td>No effect</td>
<td>Greater $, higher GRE, master’s degree led to higher persistence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case &amp; Blackwelder</td>
<td>many</td>
<td>2-yr persistence</td>
<td>80%</td>
<td>Only math considered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groen, Jakubson, Ehrenberg, Condie, Liu</td>
<td>1991-2001</td>
<td>Attrition/Completion</td>
<td>39% (attr.); 50% (comp.)</td>
<td>Humanities and related social sciences</td>
<td>Reduced cohort size &amp; increased financial aid and student quality have positive impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nettles &amp; Millett</td>
<td>21</td>
<td>Completion</td>
<td>50-75%</td>
<td>H &lt; S &lt; P, N No effect</td>
<td>White &amp; international students higher completion than African Americans in STEM &amp; social sciences</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **H** = Humanities, **S** = Social Sciences, **P** = Physical Sciences, **N** = Natural Sciences, **L** = Life Sciences.
The first 16 of the studies listed in Table 1 were discussed in more detail in the 2004 *Ph.D. Completion and Attrition* (Council of Graduate Schools) report. The first of the two additional studies cited in this table, the study by Groen et. al (2005), is a report from the Cornell Higher Education Research Institute on the Mellon Graduate Education Initiative (GEI), which documented the effects of an $80-million initiative to improve Ph.D. programs in the humanities and related social sciences through grants to 51 top-ranked graduate departments from 1991 to 2001. This study showed decreases in average attrition rates of 3 percentage points for students who entered their programs between 1982 and 1990, which were made possible through increases in financial aid, improved student quality, and reductions in cohort size (Groen et. al 2005; Ehrenberg et. al 2006).

The final study listed in Table 1 is by Nettles and Millet (2006), who conducted the largest survey to date of American doctoral students. Their analysis was based on a sample of over 9,000 students from 21 institutions and 11 fields of study. They found an overall six-year completion rate of 62% among the sample of students who had completed their first year of doctoral study when surveyed. They also found that African Americans completed at lower rates than white and international students in engineering, the sciences, mathematics, and the social sciences—and that Hispanics completed at lower rates than whites only in engineering. In all fields, research productivity appeared to be an important predictor of Ph.D. completion. In education, engineering, and the social sciences, having a mentor was positively related to degree completion. And students with children were more likely to interrupt their doctoral enrollment.

Studies such as these have generated growing public interest in Ph.D. completion rates in the U.S. for a number of reasons: demographic changes both within universities and in their surrounding populations, heightened public discussion of the need for greater accountability in higher education, and a widely recognized imperative to deepen the domestic pool of high-end talent in order to meet the employment needs of the twenty-first century. In addition, as the focus of graduate program assessment shifts from inputs to outcomes, Ph.D. completion rates are increasingly recognized as measures of graduate program quality. This link to program quality is reflected in the National Research Council’s decision to include completion rate data in its most recent assessment of U.S. research doctorate programs (forthcoming).
Project Overview

In response to rising concerns about the costs and implications of Ph.D. attrition, the Council of Graduate Schools initiated its Ph.D. Completion Project. In 2004, CGS engaged senior administrators, faculty, graduate students, and the graduate education research community from across the spectrum of research universities in the U.S. and Canada in an effort to enhance our understanding of Ph.D. completion rates, attrition patterns, and the institutional factors that influence them. The broader goal of the project is to empower universities with proven strategies for positive change. The Ph.D. Completion Project is now a six-year, grant-funded initiative that addresses the issues surrounding Ph.D. completion and attrition. During the first phase of this project (2004-2007), the Council of Graduate Schools, with generous support from Pfizer, Inc. and the Ford Foundation, provided funding to 21 major U.S. and Canadian research universities to create and pilot intervention projects and to evaluate the impact of these projects on doctoral completion rates and attrition patterns. An additional 24 project partner universities participated in various aspects of this project.3 This pool of universities is expanding with the second phase (2007-2010), in which 22 research partners and several project partners are included. The Ph.D. Completion Project aims to produce a cadre of graduate deans who, as leaders on their campuses and in the national community, can speak to the importance of reducing attrition in doctoral programs and can point to specific strategies for increasing doctoral completion.

One of the main goals of this project is to identify proven strategies to increase Ph.D. completion rates of underrepresented racial/ethnic minorities (African Americans, Latinos, and Native Americans) in all fields, as well as the completion rates of women, especially in engineering, mathematics, and the sciences—fields in which their overall completion rates are lower than those of men. CGS hopes that this project will produce documented evidence about interventions that have proven effective for men and women and for minority and majority students, overall and by field.

As the project develops and additional data are submitted and analyzed, one long-term goal will be to document the net impact of clusters of interventions. Some of these may be documented to be most effective within specific fields and programs, whereas other interventions may work better in some institutional contexts than in others. While we recognize that the project will probably be unable to isolate one strategy from all others as having a decisive

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3 For a complete listing of Research Partners and Project Partners in Phase I of the project, see Appendix B.
effect on completion, correlations of cluster-effects should be demonstrable, and case studies will supplement quantitative analysis. Finally, because CGS encourages its member universities to engage each other in a constant exchange of ideas about those practices that appear to be having an early positive impact and to make mid-course corrections where appropriate, we have not attempted at this stage of the project to identify “controls” (though it may be possible to do so in retrospect at a later stage of the project).
For Phase I of the Ph.D. Completion Project, program-level completion and attrition data were submitted by 30 institutions in 2004 and 2005. Covering twelve academic years starting in 1992-93 and ending in 2003-04, the data represent 330 programs and 49,113 students in 62 disciplines. (See Appendix C for more details.) The primary motive for collecting these data has been to give participating universities and programs a baseline from which to measure the impact of their proposed intervention strategies. According to many of the participating universities, a secondary benefit has been the increased communication among the various units that collect these data on each campus (e.g., the participating departments, the institutional research offices, and the graduate schools), which has led to more consistent data definitions within their institutions and a better understanding of the data’s meaning and value.

Beyond its usefulness to participants in this project, we believe that the following analysis of program-level baseline data will be valuable to the larger graduate and research community, as well as to the other stakeholders in the enterprise of doctoral education. As noted in the first study in the current CGS series, Ph.D. Completion Project: Preliminary Results from Baseline Data (Denecke and Frasier, CGS Communicator, 2005).

A system for providing more complete and accessible information about graduate completion and attrition is in the interest of federal agencies (which must decide how to fund doctoral education and where to direct those funds), of research universities (with responsibility for recruiting students, providing the education, and granting the degrees), and doctoral students. A more transparent system of data-sharing on graduate completion and attrition is particularly important for prospective students who must decide whether and where to spend a significant portion of their lives in pursuit of a Ph.D. degree. (p.5)
The growing need for accurate data on Ph.D. attrition and completion rates by program and institution also reflects two national trends: the demand for greater accountability at all levels of higher education and the increased use of attrition and completion rates among the outcomes upon which program quality is judged. But collecting accurate—and meaningful—data on Ph.D. completion and attrition is fraught with challenges: e.g., differences among universities and even individual programs as to when doctoral study begins, the difficulty of tracking students who “stop out” but do not officially terminate their programs, and the difficulty of tracking and classifying students who transfer from one institution to another or from one doctoral program to another within the same university. Moreover, as Denecke and Frasier (2005) point out in an article in the November 2005 edition of the CGS Communicator, “Meaningful attrition rates cannot be calculated simply by subtracting the number of students who complete from the number of enrolled students [within a given time frame],” because some of those students enrolled at the end of the time frame studied will go on to complete their degrees in subsequent years (“Ph.D. Completion Project: Preliminary Results from Baseline Data,” p. 2). It is also important to understand variations in attrition and completion patterns by discipline and broad field, including whether, within a given field, attrition is most likely to occur early or late in students’ programs.

Finally, the data generated by this study should be useful to universities and programs other than the project participants as they scrutinize their own attrition and completion patterns, as well as to professional societies seeking to increase completion rates within the disciplines they represent. As the following data analysis will show, these patterns differ significantly both within and across broad fields, so that a “target” completion rate for Ph.D. programs in engineering may not be appropriate for Ph.D. programs in the humanities. On the other hand, the average completion and attrition rates presented in this study by discipline and broad field may serve as benchmarks for other programs in the same disciplines as they are assessed or as they assess themselves.

Four features of the baseline data from the Ph.D. Completion Project may significantly advance our understanding of Ph.D. completion and attrition patterns nationally: the templates and methodology that CGS has developed for the collection of baseline attrition and completion data in order to ensure consistency, the longitudinal and nuanced analyses of those data, the size of the database, and the diversity of programs and institutions contributing to it.
Templates Used for Data Collection
CGS developed three templates to collect the quantitative baseline data on completion and attrition patterns for the Ph.D. Completion Project: the completion data template, the attrition data template, and the aggregate demographic completion data template. CGS also designed a survey instrument to get feedback from students, both completers and non-completers, on the factors they believe contributed to their success, or lack thereof, in completing the Ph.D. To protect the identity of individual students, demographic data and completion/attrition data are collected and initially presented separately. However, for the later analysis of policy factors and interventions that affect completion and attrition, data will be combined at the institutional or disciplinary level.

In the following paragraphs, the two templates that were used to collect completion and attrition data at the program level are described. In subsequent publications, the template used to collect the demographic data and the student survey instrument will be described. Each of the templates provides standard definitions for the collection and reporting of completion and attrition data.

Ph.D. Completion Data Template
The completion template (Appendix D) was designed to collect twelve years of program-level completion data, aggregated by cohort, for selected doctoral programs at each participating institution. Data were collected on the size of the entering cohort of doctoral students, the number who withdrew with a master’s degree, the number admitted to doctoral candidacy, and the number of doctoral degrees awarded annually (not cumulative) in each of years three to ten beyond initial enrollment. In addition to the aggregate numbers, data are collected in response to three questions:

1) Does your doctoral program require a master’s degree prior to admission?
2) Does your doctoral program have a continuous enrollment policy? If so, when is this policy effective? For all entering students? For students admitted to candidacy?
3) Does your program or institution distinguish between those seeking a master’s and those seeking a Ph.D.?

To ensure consistency of data submitted to the project, in the completion template CGS also established “default” definitions of both “cohort” and
“candidacy,” which are frequently defined in different ways across universities and programs. The template also provides an option with which universities can diverge from the default definition of candidacy, if institutional and/or program data cannot be adjusted to match the default. But by the establishment of default definitions, comparability between data from different institutions is significantly enhanced.

Completion Data Definitions

*Cohort:* students entering a doctoral program during a given academic year (summer, fall/winter, or spring)

*Candidacy:* the successful completion of coursework and qualifying examinations

Alternative definitions of Candidacy:

A. Successful completion of preliminary exams and/or defense of the dissertation prospectus
B. Award of the master’s degree signifies admission to doctoral candidacy
C. Candidacy is not defined or granted by the institution
D. Other

Ph.D. Attrition Data Template

The attrition template (Appendix D) captures year-by-year data, aggregated by cohort, on the attrition, enrollment, or completion status of students from the point of enrollment through ten years, as well as data that provide information on those enrolled for more than ten years. The attrition data effectively complement the completion data for further investigation of policy factors related to attrition and completion. The identified categories of attrition are as follows: withdrawal without a master’s degree; withdrawal with a master’s degree (before and after candidacy); transfer to another Ph.D. program; temporary leave (“stopping out” from the Ph.D. program, for personal, family, financial, or other reasons, with intention to return); and “information unknown.”
One challenge in analyzing the meaning of early attrition is the difficulty in determining the reliability of a student’s stated degree objective. A significant portion of early Ph.D. attrition may involve students who declare their intention to pursue a doctoral degree when they actually intend to leave with only a master’s. They may do so in order to gain admission to and/or funding from programs that favor doctoral students either partially or exclusively over master’s students. Although it is difficult to determine students’ intentions exactly, fields distinguishing between withdrawal without or with a master’s degree (before and after candidacy) are included for years one to four of the data template. These categories may help distinguish between students whose degree objective was actually a master’s degree from those whose degree objective was the Ph.D. Beginning in year five, data on withdrawal were collapsed into a single data column, “Withdrew.” The collapse of data reflects our belief that the Ph.D., not the master’s, is the likely degree objective of students who continue to enroll in a doctoral program beyond the fourth year. Data were also collected on the number of students continuing and the number of Ph.D. degrees awarded annually. As in the completion template, data in the attrition template reflect annual, not cumulative, values for the categories of attrition, completion, and enrollment.

The next chapter of this report presents selected analyses of the baseline program completion and attrition data.
As previous chapters have indicated, increasing attention is being paid to students’ completion of their doctoral programs, and several studies of completion and attrition rates have been conducted over the past thirty years. Data collected by the Ph.D. Completion Project can be expected to provide a different picture of completion rates and patterns than those presented in studies conducted previously. However, the results of the Completion Project are not directly comparable to those from other studies, due to differences in the studies’ designs, numbers of participating institutions, and other factors. This chapter analyzes the Completion Project’s baseline data on doctoral student completion and attrition rates.

The analysis will be presented for three groups of entering cohorts. Most of the analysis will focus on ten-year completion rates for the cohorts that started their doctoral programs from 1992-93 through 1994-95. These cohorts will be referred to as A-cohorts. First, the overall cumulative average ten-year completion rates will be described and compared by broad field of study, discipline, institutional type, and cohort size. Then, to investigate the changes, if any, in average completion rates over time, comparisons will be made of the seven-year completion rates between two cohort groups: the A-cohorts, as described above, and B-cohorts, which include students who started between 1995-96 and 1997-98. Attrition rates will then be analyzed across disciplines, institutional types, and cohort sizes for the A-cohorts, and early attrition analyses will be presented for A- and B-cohorts, as well as for students who started their programs from 1998-99 through 2000-01, the C-cohorts.

**Ten-Year Completion Rates**

The data (from the A-cohorts) used in the analysis of ten-year completion rates at the aggregate and broad-field and discipline levels consisted of 12,135 students across 58 disciplines. The students and disciplines were distributed across five broad fields as follows: Engineering (17.8%), Life Sciences (12.6%), Mathematics & Physical Sciences (30.1%), Social Sciences (22.0%), and Humanities (17.6%) (see Appendix C).
Analysis of data from the Ph.D. Completion Project suggests that almost half the students who enroll in doctoral programs within this broad set of fields complete their doctoral degrees within seven years. As Figure 4-1 shows, 45.5% of the doctoral students who started their programs in 1992-93 through 1994-95 had completed within seven years. By the end of the tenth year, however, the completion rate grows to 56.6%. The 11.1 percentage point growth in completion rates between the seventh and tenth years also indicates that there is a great deal of progress toward degree completion during these three years. As later figures in this chapter will show, Ph.D. completion after the seventh year of study varies by broad field of study, academic program, type of institution, student cohort size, and other factors.

Figure 4-1 Average Cumulative Overall Ten-Year Completion Rates for Students Entering Doctoral Programs from 1992-93 through 1994-95, by Years.

![Bar chart showing completion rates over ten years.](chart)

Source: Council of Graduate Schools Completion and Attrition Program Data
Completion Rates by Broad Field

Completion rates vary a great deal between Science, Engineering and Mathematics (SEM) fields and Social Sciences and Humanities (SSH) fields. The average completion rate in SEM fields is noticeably higher than that for SSH fields. However, as Figure 4-2 shows, the average SSH rate of completion appears to increase steadily even at the ten-year mark, which suggests that a significant number of SSH students continue their studies after a decade.

In the SEM fields, more than half the students complete their doctorates by year seven, and by the tenth year, almost 60% of SEM students have received their Ph.D.s. While between years seven and ten, the overall completion rate for SEM fields grows by 7.2 percentage points (from 51.9% at the seventh year to 59.1% at the tenth year), the rate for SSH students rises by 17.2 percentage points (from 35.8% at the seventh year to 53.0% at the tenth year). At year ten, the overall completion rate in SSH fields is still increasing at a steady pace, but in SEM fields growth in the completion rate has become minimal.

Figure 4-2 Average Cumulative Ten-Year Completion Rates for SEM and SSH Cohorts Beginning Doctoral Study from 1992-93 through 1994-95, by Year

[Graph showing cumulative completion rates for SEM and SSH from year 3 to year 10.]

Source: Council of Graduate Schools
Completion and Attrition Program Data
Of course, there is a great deal of variation in completion rates among the five individual broad fields, as Figure 4-3 illustrates. Engineering has the highest Ph.D. completion rate throughout almost all the ten-year time period, while Humanities has the lowest. From years four to seven, Engineering has a substantially higher completion rate than the other fields. Starting in year eight, however, the completion rate for Life Sciences approaches that of Engineering, and by the tenth year Engineering has a only slightly higher completion rate (63.6%) than Life Sciences (62.9%). The field of Mathematics & Physical Sciences has a higher overall completion rate than Social Sciences at year seven, but by year ten this pattern is reversed, and the Ph.D. completion rate for Social Sciences (55.9%) has slightly surpassed that of Mathematics & Physical Sciences (54.7%).

Figure 4-3 also shows that the timing for reaching the 50% completion rate in the five fields varies considerably. In Engineering, the 50% completion rate is reached shortly after the six-year mark; in Life Sciences, it occurs between years 6 and 7; in Mathematics & Physical Sciences, at about year 7.5; and in Social

Figure 4-3 Average Cumulative Ten-Year Completion Rates for Cohorts Entering Doctoral Study from 1992-93 through 1994-95, by Broad Field and Year
Sciences, at about year 8.5. The average completion rate for Humanities does not exceed 50% during the ten-year period; however, it jumps considerably between years seven and ten. Conversely, the average completion rate for Engineering starts to plateau after the eighth year, which suggests that only a small number of Engineering students completed the Ph.D. after their eighth year of study. The plateau occurs in Life Sciences and Mathematics & Physical Sciences after the ninth year, indicating that limited degree completion would occur after that time. Completion rates in Social Sciences and Humanities appear to continue to rise after year ten; it is therefore possible that a significant number of students in these two fields will continue their studies and complete their degrees after their tenth year.

The differences in completion rates across the five broad fields may be due to various reasons, such as variations in the availability, amount and duration of financial support, the quality of academic advising and mentoring, dissertation and degree requirements, and future job prospects. While some of these causes may be beyond the control of graduate deans and other program administrators, institutional and program policies may influence future changes in completion rates. Investigating the factors that affect timely completion is one of the important goals of the Ph.D. Completion Project. Later publications in the *Ph.D. Completion and Attrition* series will examine these policies more closely.

**Completion Rates by Discipline**

This section examines the differences in Ph.D. completion rates at the disciplinary level. The disciplines used here are based on definitions developed by the National Research Council. As previously stated, the Ph.D. Completion Project includes data from 330 doctoral programs at 30 institutions. However, in order to have a sufficient number of observations for the disciplinary analysis, only disciplines with five or more programs in the project were included. Again, only the A-cohorts, students who entered their doctoral programs between 1992-93 and 1994-95, are included in the analysis. Therefore, data from 258 programs are represented in the disciplinary analysis in this section. (See Appendix C for the number of programs and students in each discipline.)

This section first presents an analysis of the cumulative completion rates over ten years for students in each of the disciplines represented by five or more programs within the five broad fields. The cumulative completion rates are shown in the line graphs.
Additionally, box-and-whisker plots are used to show the distribution of completion rates at year ten for each discipline that has five or more participating programs. The box plots are used to illustrate a graphical summary of the sample distribution indicators across institutions within each discipline: a measure of central location (the median\(^4\), shown as the line inside the box in Figure 4-5, for example), two measures of dispersion (the range, shown as the whisker, and the inter-quartile range\(^5\), shown as the box), the skewness (from the orientation of the median relative to the quartiles) and potential outliers (marked as individual dots). Each observation in the box plot represents a program. With the above set of indicators, the sample distributions of disciplines within a broad field can be compared. The range normally labels the minimum and maximum values that are less than or equal to 1.5 times the inter-quartile range below the first quartile or beyond the last quartile. The outliers are the observations outside the range.

The reasons for including the box charts are threefold. First, the box charts offer complementary information to the line graphs because these two types of graphs have different units of analysis. The line graphs present a completion rate computed across all sampled students, while the box charts present completion data across programs. Second, the two types of charts present completion rates over different time spans. The line graphs present data across ten years, while the box charts present data for only the tenth year. Third, these two types of charts exhibit different statistical information. The line graphs provide information on overall completion rates by year, while the box charts display the medians, variance and inter-quartile ranges across the completion rates for each program.

\(^4\) The median value is the half-way point in a distribution. Half the programs have completion rates that are above the median, and half have rates that are below.

\(^5\) The inter-quartile range is equal to the length of the box in a box plot. It includes the middle 50% distribution of the observations. Within the distribution of the completion rates, the lowest quarter of the observations are less than or equal to the first quartile, and the highest quarter are greater than or equal to the highest quartile.
Engineering

Civil Engineering has substantially higher completion rates than the other Engineering disciplines. At year seven, Civil Engineering has already reached a completion rate of 69%, as shown in Figure 4-4. Chemical Engineering and Mechanical Engineering have very similar completion rates from years three through ten. For those two disciplines, Ph.D. completion rates reach approximately 60% at year eight, but from year eight to year ten, the completion rates increase by only 2 or 3 percentage points. While Biomedical Engineering starts with one of the highest early completion rates in this group at year three, its completion rate does not increase as fast as other Engineering disciplines from year three through year six. Electrical & Electronics Engineering, however, has the lowest rate of completion after year five. Completion rates in all four engineering disciplines begin to plateau after year seven, though Biomedical Engineering and Civil Engineering still have slight growth.

Figure 4-4 Average Ten-Year Cumulative Completion Rates for Students Entering Five Engineering Doctoral Disciplines from 1992-93 through 1994-95, by Year

![Graph showing cumulative completion rates for five engineering disciplines from years 1 to 10.](source: Council of Graduate Schools Completion and Attrition Program Data)
Figure 4-5 shows the median and variations in completion rates for the five engineering disciplines at the tenth year. Figure 4-4 shows that Mechanical Engineering has a higher mean completion rate than Chemical Engineering at year ten; however, the median completion rates for the seven Chemical Engineering programs and the eleven Mechanical Engineering programs are the same (66.67%) at year ten (see Figure 4-5).

Also, completion rates for the Chemical Engineering programs have a smaller amount of variance and a smaller inter-quartile range. About half of the Chemical Engineering programs have completion rates in the narrow range between 66% and 70%. Mechanical Engineering programs have the largest variance, the largest inter-quartile range, and an outlier. Electrical & Electronics Engineering programs have the lowest median completion rate at year ten and have the smallest range and smallest inter-quartile range, but have three outliers. Civil Engineering programs have the highest completion rate at year ten and have a small variance, which indicates that Civil Engineering programs have the most concentrated high completion rates among the Engineering disciplines. Civil Engineering programs also have a small range like Electrical and Electronics Engineering, but they have an inter-quartile range similar to Biomedical Engineering. The smaller range and smaller inter-quartile range normally indicate more homogenous completion rates.

Figure 4-5 Inter-Quartile Ranges of Cumulative Completion Rates for Cohorts Beginning from 1992-93 through 1994-95, for Engineering Disciplines with Five or More Programs, at Year Ten

6 Appendix C lists the number of programs in each major discipline.
7 The outlier in Mechanical Engineering is for a program in which there were 11 entering students and none completed.
Life Sciences

Among the Life Science disciplines, completion rates generally rise quickly from year four to year seven, as shown in Figure 4-6. After year eight, completion rates for most of these disciplines begin to plateau; by this time, more than 50% of the students have completed. The completion rate for Genetics & Molecular Genetics surpasses other disciplines at year six after sharp growth between years five and six. Microbiology & Immunology starts with the highest early completion rate and has the second highest completion rate among all Life Science disciplines at year seven, and almost shares the highest completion rate at year ten with Genetics & Molecular Genetics. Biology, Neuroscience, and Molecular & Cellular Biology start with barely any Ph.D. completion at year three and then diverge. At year eight, Neuroscience and Molecular & Cellular Biology have similar completion rates, while Biology has the lowest completion rate among these disciplines. By the tenth year, the Ph.D. completion rates for all the five disciplines range between 59.4% and 69.3%.

Figure 4-6 Average Ten-Year Cumulative Completion Rates for Students Entering Five Life Science Doctoral Disciplines from 1992-93 through 1994-95, by Year

![Graph showing cumulative completion rates for various Life Science disciplines from year 3 to year 10.](image-url)
The distribution of the ten-year program completion rates within the Life Science disciplines (see Figure 4-7) reveals that programs within the discipline of Genetics & Molecular Genetics have the highest median completion rate, followed in turn by Molecular & Cellular Biology, Microbiology and Immunology, Biology, and Neuroscience. The values of the median completion rates at the program level and their orders differ from the overall completion rates across all students for each discipline (see Figure 4-6). Neuroscience has the lowest median completion rate at the program level, compared to other Life Science disciplines. Its median completion rate is very close to its first quartile, which indicates that half of the Neuroscience programs have completion rates between 55% and 60%.

Figure 4-7 Inter-Quartile Ranges of Cumulative Completion Rates for Cohorts from 1992-93 through 1994-95, for Life Science Disciplines with Five or More Programs, at Year Ten

![Box plot of cumulative completion rates for Life Science disciplines](image-url)
Mathematics & Physical Sciences

Among the Mathematics & Physical Science disciplines (Figure 4-8), Chemistry has the highest rate of student completion, while Computer & Information Sciences has the lowest. At year ten, the completion rates of the four disciplines within this broad field range from 41.5% to about 61.6%. Most growth in completion occurs from year four to year eight or nine and then reaches a plateau.

Figure 4-8 Average Ten-Year Cumulative Completion Rates for Students Entering Mathematics & Physical Science Doctoral Disciplines from 1992-93 through 1994-95, by Year

Computer & Information Science programs also have the lowest median completion rate and the smallest variance and inter-quartile range (see Figure 4-9) at the program level among the Mathematics & Physical Science disciplines at the tenth year. Mathematics has the second lowest median completion rate at year ten, but has the largest variance and inter-quartile range, with the highest completion rate for a single program of about 80%. This high completion rate is similar to the rates for some Chemistry and Physics & Astronomy programs.
As discussed earlier, the Social Science disciplines tend to have strong Ph.D. completion rates after the sixth year of initial enrollment. Generally, completion rates in most Social Science disciplines appear to continue to increase after year ten, except for Economics, where the completion rate appears to reach a plateau between years nine and ten (see Figure 4-10). At year ten, Communications has the highest average completion rate (67%), followed by Psychology (65%), while the other disciplines have rates that range from 44% to 52%. The completion rate for Psychology increases quickly between years four and seven. At year three, while three of the disciplines have average completion rates below 10%, the completion rate for Communications is 24%. Sociology and Political Science have very similar completion patterns. They start with a very low average completion rate (below 5%) at year three and then have steady growth. By year ten, although they have the lowest completion rates (less than 45%) among this group of disciplines, there seems to be continuing growth in their completion rates, which suggests that some students may complete after...
their tenth year. Anthropology & Archaeology has the lowest completion rate through year eight, but between years nine and ten, the completion rate of this discipline accelerates, and by year ten it surpasses Sociology and Political Science and reaches a completion rate of 46%. Further, the slope of this curve continues to grow, which suggests that some students may complete their studies after the tenth year.

Figure 4-10 Average Ten-Year Cumulative Completion Rates for Students Entering Six Social Science Doctoral Disciplines from 1992-93 through 1994-95, by Year

The rank order of the median completion rates for the Social Science disciplines is basically consistent, with one minor exception (for Sociology and Anthropology & Archaeology), with the rank order of their mean completion rates, as shown in Figure 4-11. However, there is a great deal of variation in the median ten-year completion rates at the program level across these disciplines. Programs in Economics and Communications have the smallest variance and smallest inter-quartile range, while programs in Psychology have the largest variance and the largest inter-quartile range.
Humanities

Ph.D. completion rates for disciplines within the Humanities are more homogeneous than those in other broad fields. As Figure 4-12 shows, they generally start with low average completion rates (11% or less) at year three and then have steady growth through year ten. Ten years after initial student enrollment, these disciplines all approach a 50% average completion rate, but the upward trajectory of the rates suggest that degree completion continues to grow thereafter. At year seven, Foreign Languages & Literature holds the highest average completion rate (34.4%), followed by English Language & Literature (33.0%), Philosophy (30.8%), and History (24.7%).
Consistent with the mean completion rates at year ten, the median completion rates of programs within the Humanities broad field also concentrate at a similar value (around 50%). Programs in English Language & Literature have the highest median completion rate (as shown in Figure 4-13). The variances and inter-quartile ranges of programs within these disciplines do not vary dramatically, although Foreign Languages & Literature appears to have the largest variance.
Completion Rates by Institution Type

Completion rate by institution type is another factor to consider. There are some differences between public and private institutions that could influence completion rates, such as sources of funding and flexibility in using those funds. This section thus examines completion rates for public and private universities that are participating in the Completion Project. Of the 30 research and project partner universities within the Completion Project, 20 are public institutions.

As Figure 4-14 shows, the overall average ten-year Ph.D. completion rate at public universities is nearly identical to that at private institutions. Public institutions seem to have slightly higher completion rates before year five, but thereafter private institutions have a slightly higher average completion rate.
In all broad fields except Mathematics & Physical Sciences and Humanities, average completion rates by institution type are similar (shown in Figure 4-15). In Mathematics & Physical Sciences, the two types of institutions start with nearly the same early completion rate at year three, then begin to diverge after year four, when private institutions clearly have higher completion rates. In Humanities, private institutions always have slightly lower completion rates, while in Engineering, Social Sciences, and Life Sciences, public and private institutions have nearly identical rates after year five. In Life Sciences, private institutions have slightly lower completion rates until year six but surpass public institutions thereafter.
Completion Rates by Cohort Size

Some research (e.g., Brown & Rudenstine, 1992) has suggested that cohort size affects Ph.D. completion rates. These previous studies have reported that students in smaller classes have higher completion rates, presumably because students receive more individual attention from their instructors.

In this section, which compares average completion rates by cohort size, cohort size is based on the sample distribution for the size of entering cohorts within each program at the institutions participating in the Completion Project. The cohorts are placed into three groups:

“Small”-- cohort size ranging from 1 to 7 students
“Medium” --cohort size ranging from 8 to 14 students
“Large”-- cohort size of 15 students or above
Overall, as Figure 4-16 illustrates, among the 874 entering cohorts across all 313 programs at 30 institutions from 1992-93 to 1994-95, Ph.D. completion rates vary only slightly by cohort size during the ten years from initial entry into doctoral study. Small, medium, and large cohorts all display a very similar pattern, particularly for years one through six. After year seven, large cohorts appear to have the highest average completion rate, while small cohorts have the lowest, but the differences between highest and lowest are minimal.

**Figure 4-16 Average Cumulative Ten-Year Completion Rates by Cohort Size for Students Entering Doctoral Programs from 1992-93 through 1994-95, by Year**

![Graph showing completion rates by cohort size and field](image)

Source: Council of Graduate Schools Completion and Attrition Program Data
Figure 4-17 below shows the differences in average completion rates by cohort size and broad field. In all broad fields, patterns of completion rates by cohort size are very similar. However, there are some small differences. Large cohorts tend to have slightly higher completion rates than medium and small cohorts in Social Sciences and Mathematics & Physical Sciences. Small cohorts have slightly higher completion rates in Engineering, while medium cohorts have slightly higher rates in the Humanities. Completion rates in the Life Sciences are almost identical for large and medium cohorts, both of which are slightly higher than for small cohorts after year six.

However, the relatively small or even unclear cohort-size effects shown in Figures 4-16 and 4-17 might be masked by the substantial differences in disciplinary configuration between the “small”, “medium”, and “large” cohort groups within a broad field. For example, in the broad field of Mathematics & Physical Sciences, cohort size has an opposite effect for Chemistry than it has for Computer & Information Sciences. Chemistry has the highest completion rate in this broad field, while Computer & Information Sciences has the lowest completion rates after year five (see Figure 4-8). Chemistry has a total of 1,384...
students, while Computer & Information Sciences has 615 students. The cohort-size distribution for those two disciplines also differs: for Chemistry programs, the smallest one-third of cohorts range from 2 students to 15 students, medium cohorts range from 16 to 26 students, and the large cohorts range from 31 to 78 students; for Computer & Information Sciences, the small cohorts range from 4 to 10 students, medium cohorts range from 12 to 23 students, and large cohorts range from 25 to 55 students. Based on this specific-to-discipline definition for cohort sizes, instead of an overall definition for the broad fields, the cohort-size effect becomes more pronounced and differs across disciplines. Figure 4-18 displays a clear positive correlation between cohort size and completion rates in Chemistry: the large cohorts have the highest completion rates, and small cohorts have the lowest completion rates after year six. However, for Computer & Information Sciences (Figure 4-19), large cohorts have the lowest completion rates, and the small cohorts have the highest completion rates, particularly for years four through nine.

**Figure 4-18 Average Cumulative Ten-Year Completion Rates for Chemistry by Cohort Size for Doctoral Students Entering from 1992-93 through 1994-95 and Year**

![Figure 4-18](image)

**Note:**
“Small”-- cohort size ranging from 2 to 15 students
“Medium” --cohort size ranging from 16 to 26
“Large”-- cohort size ranging from 31 to 78
Figure 4-19 Average Cumulative Ten-Year Completion Rates for Computer & Information Sciences by Cohort Size for Doctoral Students Entering from 1992-93 through 1994-95 and Year

Note:
“Small”-- cohort size ranging from 4 to 10 students
“Medium” --cohort size ranging from 12 to 23
“Large”-- cohort size ranging from 25 to 55

Seven-Year Completion Rates

The above comparisons are all based on cohorts of students that entered doctoral programs from 1992-93 to 1994-95. Using these cohorts makes possible the examination of trends in doctoral completion for students who could have been enrolled in their programs for as many as ten years. To investigate whether students who entered Ph.D. programs after 1994-95 had different completion rates and patterns, this section compares seven-year completion rates between cohorts entering from 1992-93 to 1994-95 and cohorts entering from 1995-96 to 1997-98. Students who entered Ph.D. programs from academic year 1992-93 through 1994-95 are designated as A-cohorts, and students who began doctoral study from 1995-96 through 1997-98 are labeled as B-cohorts. A comparison of these two cohort groups makes it possible to determine if...
seven-year completion rates changed between the time that the first cohort of students began their doctoral programs in 1992-93 and the time that the second cohort began in 1995-96.

As Figure 4-20 shows, there are only minor differences in average seven-year completion rates between A- and B-cohorts in SEM and SSH fields. In SEM fields, B-cohorts have a slightly lower average completion rate (50.6%) than A-cohorts (51.9%); but in SSH fields, B-cohorts have essentially the same average completion rates, 35.8% versus 35.7%.

**Figure 4-20 Comparison of Seven-Year Cumulative Completion Rates between A- and B- Cohorts at Year Seven, by SEM vs. SSH Fields**

![Graph comparing completion rates between A- and B-cohorts in SEM and SSH fields](image)

There is relatively little difference in average seven-year completion rates between the A- and B- cohorts in terms of the five individual broad fields (see Figure 4-21). Only in Engineering do the two cohorts show a difference in seven-year completion rate greater than 1.2 percentage points, but the difference is still relatively small (56.8% for A-cohorts and 53.9% for B-cohorts).
So far, we have described and compared completion rates by broad field, discipline, institutional type, and cohort size, but we have yet to discuss the students who did not complete doctoral study—the patterns of student attrition. Completion and attrition tell us different things about doctoral programs. Students who do not complete doctoral study within a designated time frame either have left the program or are continuing to pursue the degree. Analyzing completion rate delineates the magnitude and timing of completion; studying attrition allows for an analysis of the magnitude and reasons for non-completion. Investigating attrition patterns also helps to enhance our understanding of completion rates.

Overall cumulative attrition rates increase each year after the initial year of entering doctoral study (see Figure 4-22). Most students who leave their doctoral programs appear to do so relatively early, as attrition rates increase sharply during the first four years. In the first year, 6.6% of Ph.D. students left their programs; at year two, the cumulative attrition rate more than doubled. At year four, the attrition rate grew to 23.6%. Thereafter, the attrition rate tends to stabilize.
Attrition Rates by SEM vs. SSH Fields

Across fields there are noticeable differences in attrition trends. In SEM fields, attrition rates are higher than those in SSH in each of the ten years after students entered their doctoral programs (as shown in Figure 4-23). Cumulative attrition rates for the first four years increase very quickly in SEM fields but thereafter slow through year ten. In SSH fields, the average cumulative attrition rate increases more gradually during the first four years and thereafter increases at a faster rate than in the SEM fields.
Figure 4-23 Cumulative Ten-Year Attrition Rates for Doctoral Student Cohorts Entering from 1992-93 through 1994-95, for SEM vs. SSH Fields, by Year

Attrition Rates by Broad Field

Cumulative attrition rates by broad field are shown in Figure 4-24. While cumulative overall attrition rates follow a pattern similar to that of completion rates, they do not vary as much across broad fields, and the rank order across the broad fields differs from that of the completion rates. Cumulative attrition rates are highest in Mathematics & Physical Sciences. By year ten, 36.9% of students in this broad field have left their programs without a doctoral degree. Early attrition in Humanities does not grow as fast as other fields, but it grows steadily each year through year ten; by year seven, it has the second highest rate of cumulative attrition. Engineering ranks third after year seven, followed very closely by Social Sciences and Life Sciences. At year ten, the attrition rate of Social Sciences catches up with that of Engineering.

After year four, cumulative attrition rates in the Humanities increase much faster than in the other broad fields. The slope of the curve for Humanities after year seven keeps a strong momentum of increase, suggesting that its attrition rate may continue to increase after year ten. Social Sciences may also experience growing attrition after year ten, though apparently not as strongly.
as the Humanities. Attrition for Engineering and Life Sciences, conversely, appears to have reached a plateau at year eight, which suggests a stabilized late attrition rate.

Figure 4-24 Cumulative Ten-year Attrition Rates for Doctoral Student Cohorts Entering from 1992-93 through 1994-95, by Broad Field and Year

Attrition Rates by Discipline

Within broad fields, attrition rates vary considerably at the disciplinary level. As was the case with the completion analysis, the analysis of attrition patterns will be presented only for disciplines with five or more programs participating in this study.
Figure 4-25 shows the variation in ten-year cumulative attrition trends in Engineering. All five Engineering disciplines start with similar attrition rates (3.5%-7.6%) at year one and begin to plateau after year four or five. However, attrition rates in years one to four increase with different magnitudes: Electrical & Electronic Engineering has the fastest growth of cumulative attrition rates during this period, followed by Chemical Engineering and Mechanical Engineering. At year ten the accumulative attrition rates for these three disciplines are 43.4%, 28.8 %, and 26.3%, respectively. Civil Engineering has the lowest cumulative attrition rate of 14.4% over the ten-year period, followed by Biomedical Engineering at 20.3%.

**Figure 4-25 Cumulative Ten-Year Attrition Rates for Doctoral Student Cohorts That Entered Engineering Disciplines from 1992-93 through 1994-95 at Five or More Programs, by Year**

![Cumulative Attrition Rate Graph](image)

NOTE: 10-Year Attrition Rates include all cohorts entering 1992-93 through 1994-95
Source: Council of Graduate Schools
Completion and Attrition Program Data

In Life Sciences (shown in Figure 4-26), Biology has a much higher cumulative attrition rate than the other four Life Science disciplines. Biology has the highest attrition growth rate in years one through four and does not seem to plateau until year nine. However, the other four disciplines all reach plateaus in their cumulative attrition rates at year seven, indicating stabilized attrition after that time. By year ten, a very clear hierarchy of cumulative attrition rates occurs. Biology has the highest attrition rate at 38.5%, followed by Neuroscience.
(22.2%), Microbiology & Immunology (20.3%), Molecular Cellular Biology (19.1%), and Genetics & Molecular Genetics (14.2%).

**Figure 4-26 Cumulative Ten-Year Attrition Rates for Doctoral Student Cohorts That Entered Life Science Disciplines from 1992-93 through 1994-95 at Five or More Programs, by Year**

For Mathematics & Physical Sciences disciplines (see Figure 4-27), a clear hierarchy of cumulative attrition rates is easily identified throughout the ten years after initial enrollment. At year ten, Computer & Information Sciences has the highest attrition rate (51.4%), followed by Mathematics (39.9%), Physics & Astronomy (33.1%), and Chemistry (31.7%). Mathematics and Chemistry appear to have reached plateaus around year nine, while the other two disciplines do not appear to have reached plateaus around year ten.
As Figure 4-28 below indicates, Social Sciences disciplines have diverging cumulative attrition trends over the ten years after initial student enrollment. Although all disciplines have similar attrition rates at year one (ranging from 3.2% to 10.8%), Political Science has the largest growth in attrition and reaches 37.6% at year ten. Sociology and Anthropology & Archaeology have similar tenth-year attrition rates, 32.7% and 31.5% respectively, followed by Economics (28.4%), Psychology (23.0%), and Communications (12.8%). The attrition rate in Anthropology & Archaeology increases at a steady rate over the ten-year period after enrollment and is still rising at year ten.

NOTE: 10-Year Attrition Rates include all cohorts entering 1992-93 through 1994-95
Source: Council of Graduate Schools
Completion and Attrition Program Data
As Figure 4-28 below indicates, Social Sciences disciplines have diverging cumulative attrition trends over the ten years after initial student enrollment. Although all disciplines have similar attrition rates at year one (ranging from 3.2% to 10.8%), Political Science has the largest growth in attrition and reaches 37.6% at year ten. Sociology and Anthropology & Archaeology have similar tenth-year attrition rates, 32.7% and 31.5% respectively, followed by Economics (28.4%), Psychology (23.0%), and Communications (12.8%). The attrition rate in Anthropology & Archaeology increases at a steady rate over the ten-year period after enrollment and is still rising at year ten.

**Figure 4-28 Cumulative Ten-Year Attrition Rates for Doctoral Student Cohorts That Entered Social Sciences Disciplines from 1992-93 through 1994-95 at Five or More Programs, by Year**

![Cumulative Ten-Year Attrition Rates Graph](image_url)

**NOTE:** 10-Year Attrition Rates include all cohorts entering 1992-93 through 1994-95

Source: Council of Graduate Schools Completion and Attrition Program Data
Figure 4-29 illustrates increasing attrition rates for Humanities disciplines throughout the ten-year period after initial enrollment. Starting with attrition rates ranging from 4.6% to 8.2% at year one, the four Humanities disciplines have similar growth patterns. English Language & Literature has the lowest growth rate after year two and thus ends up with the lowest attrition rate (26.7%) at year ten. Foreign Languages & Literature (36.9%) and History (35.5%) have the highest attrition rates among Humanities disciplines at year ten, while Philosophy has a ten-year rate of 31.8%. None of the four disciplines appears to have reached a plateau in attrition at year ten.

Figure 4-29 Cumulative Ten-Year Attrition Rates for Doctoral Student Cohorts That Entered Humanities Disciplines from 1992-93 through 1994-95, at Five or More Programs, by Year

According to Figure 4-30, from years one through seven, attrition rates at public institutions are slightly higher than those at private institutions. However, the rates are essentially the same, particularly from years eight through ten.

NOTE: 10-Year Attrition Rates include all cohorts entering 1992-93 through 1994-95

Source: Council of Graduate Schools Completion and Attrition Program Data
Attrition Rates by Institution Types

As can be seen in Figure 4-30, from years one through seven, attrition rates at public institutions are slightly higher than those at private institutions. However, the rates are essentially the same, particularly from years eight through ten.

Figure 4-30 Cumulative Ten-Year Attrition Rates for Doctoral Student Cohorts from 1992-93 through 1994-95, by Institution Type and Year

Source: Council of Graduate Schools
Completion and Attrition Program Data
Figure 4-31, which shows the trends in attrition rates by institutional type and broad field, displays a very different pattern from that at the aggregate level (see Figure 4-30). Differences in early attrition appear to be small between the two types of institutions in most broad fields. In the later years, attrition rates in Engineering, Life Sciences, Social Sciences and Humanities are higher in private institutions, while in Mathematical & Physical Sciences, public institutions have higher attrition rates, particularly in the later years.

**Figure 4-31 Cumulative Ten-Year Attrition Rates for Doctoral Student Cohorts from 1992-93 through 1994-95, by Institution Type, Broad Field and Year**

Source: Council of Graduate Schools Completion and Attrition Program Data
**Attrition Rates by Cohort Size**

As Figure 4-32 indicates, attrition rates among doctoral students do not show much variation as a function of cohort size. Large cohorts have the highest average attrition rates after year three, and medium cohorts have the lowest attrition rates after year seven.

**Figure 4-32 Cumulative Ten-Year Attrition Rates for Doctoral Student Cohorts from 1992-93 through 1994-95, by Cohort Size and Year**

Across broad fields, the previously described relationship between cohort size and attrition rates does not always apply (see Figure 4-33). Attrition rates in Engineering clearly increase with cohort size: large cohorts have the highest attrition rates, and small cohorts have the lowest across all years. However, for other SEM fields, this trend does not hold. In Life Sciences, large cohorts have the highest attrition rates after year three, while small and medium cohorts have very similar rates through year seven, and medium cohorts have lower rates in years eight through ten. Mathematics & Physical Sciences’ large and small cohorts have similar attrition trends, while medium cohorts have slightly lower attrition rates after year three. Among SSH fields, the Social Sciences field displays opposite trends from Engineering, with small cohorts having the
highest attrition rates and large cohorts the lowest. Humanities do not show as clear a cohort-size effect as the Social Sciences. The three types of cohorts in Humanities have very similar attrition rates, though smaller cohorts tend to have minimally higher rates after year six.

**Figure 4-33 Cumulative Ten-Year Attrition Rates for Doctoral Cohorts from 1992-93 through 1994-95, by Cohort Size, Broad Field, and Year**

![Graphs by BF](source)

However, the above-mentioned cohort-size effect could actually be a compound effect of cohort size and disciplines. For example, although Figure 4-33 shows clear hierarchical attrition rates as a function of cohort sizes in Engineering, the high attrition rates in the large Engineering cohorts could be largely the result of high attrition rates in Electrical & Electronics Engineering, which has high student counts in its large cohorts. More details of these findings are presented in Appendix E.
Early Attrition

As indicated previously, attrition rates increase sharply during the first four years after initial enrollment. The following two sections therefore focus on early attrition rates, i.e. attrition rates in the first four years. Data are presented for three cohorts: the A- and B-cohorts described earlier, and C-cohorts, which include students who entered doctoral programs from academic year 1998-99 through 2000-01.

From an examination of attrition rates across the three cohort groups, it is obvious that C-cohorts consistently have a lower cumulative attrition rate than A- and B-cohorts at year four. Figure 4-34 shows the overall fourth-year cumulative attrition rates for all three cohorts. A- and B-cohorts have very similar attrition rates (23.6% and 24.2% respectively) at year four, but C-cohorts have a substantially lower attrition rate (20.2%). In both SEM and SSH fields, C-cohorts also have lower four-year attrition rates than the other two cohorts, which have similar attrition rates (see Figure 4-35).

**Figure 4-34 Overall Four-Year Cumulative Attrition Rates for A-, B- and C-Cohorts**
At the broad field level (see Figure 4-36) there is an even greater difference in four-year attrition rates between A- and B- cohorts for individual fields when compared with overall, SEM, and SSH attrition rates. However, in all broad fields the four-year attrition rates are higher for A- and B-cohorts than for C-cohorts. Except for the Humanities, C-cohorts have substantially lower attrition rates than A- and B-cohorts. These differences are more pronounced in Life Sciences, Mathematics & Physical Sciences, and Social Sciences than in Engineering and Humanities.
The lower four-year attrition rate in C-cohorts indicates that a lower percentage of students who began doctoral study in 1998-99 through 2000-01 left their programs in the first four years than of students who began study in 1992-93 through 1997-98. Future editions of the *Ph.D. Completion and Attrition* series will examine possible reasons for the lower level of attrition among students in the C-cohorts.

**Components of Early Attrition**

This section further analyzes the categories of students who contribute to early attrition during the first four years of enrollment. Early attrition includes the following categories of students:

- Students who left their institution with no master’s (*No Master’s*)
- Students who left with a master’s degree but had not reached the candidacy stage (*Master’s, No Candidacy*)
- Students who left after receiving a master’s degree *and* achieving candidacy (*Master’s, With Candidacy*)
- Students who transferred either to another doctoral program at their original institution or to another institution (*Transferred*)
Figure 4-37 shows the student components of overall early attrition. The majority of early attrition involves students who left their doctoral programs without achieving candidacy (including No Master’s and Master’s, No Candidacy), while the Transferred category accounts for only a very small proportion (less than 5%) of total attrition in each of the first four years after enrollment. At year one, approximately 6% of all entering Ph.D. students and over 90% of all students leaving their programs left without a master’s degree. At year two, almost half of those leaving their programs left without a master’s degree. Thereafter, students leaving with a master’s (either with or without candidacy) account for a growing share of attrition. Attrition due to Transferred students is highest in years two and three. The portion of early attrition by students with a master’s degree (Master’s, No Candidacy and Master’s, With Candidacy) and with candidacy is highest in the third and fourth years.

**Figure 4-37 Components of Overall Early Student Attrition for Years One through Four**

The next several figures illustrate the components of early attrition for each of the five broad fields. In Engineering (see Figure 4-38), only a very minimal share of attrition occurs among students who have advanced to candidacy. There is a slightly higher portion of attrition by Engineering students who left their programs with master’s degrees when compared with overall attrition pattern across all fields (compared to Figure 4-37). A possible explanation for this finding is that Engineering students had more
their programs with master’s degrees when compared with overall attrition pattern across all fields (compared to Figure 4-37). A possible explanation for this finding is that Engineering students had more opportunities for employment in highly paid positions upon completion of the master’s degree than students in other broad fields.

**Figure 4-38 Components of Early Student Attrition in Engineering for Years One through Four**

In Life Sciences (Figure 4-39), a dominant share of attrition occurs among doctoral students without master’s degrees at year one and to a much lesser extent thereafter; attrition of students with master’s degrees (with or without candidacy) accounts for the largest portion of attrition in years three and four. Attrition of students with candidacy occurs more often in later years and more frequently in Life Sciences than in most other fields. Transfer accounts for a small proportion of early attrition, from year two through year four but a majority transfer appears to occur in year one.
Attrition of students with candidacy seems to be more pronounced in Mathematics & Physical Sciences (see Figure 4-40) and to occur earlier (starting even in year one) than in Engineering and Life Sciences. Attrition due to transfer occurs most often in years two and three.

Source: Council of Graduate Schools Completion and Attrition Program Data
NOTE: A-cohorts include all cohorts entering 1992-93 through 1994-95
B-cohorts include all cohorts entering 1995-96 through 1997-98
C-cohorts include all cohorts entering 1998-99 through 2000-01
Attrition of students with candidacy seems to be more pronounced in Mathematics & Physical Sciences (see Figure 4-40) and to occur earlier (starting even in year one) than in Engineering and Life Sciences. Attrition due to transfer occurs most often, particularly in year two.

**Figure 4-40 Components of Early Attrition in Mathematics & Physical Sciences for Years One through Four**

![Figure 4-40 Components of Early Attrition in Mathematics & Physical Sciences for Years One through Four](image)

Source: Council of Graduate Schools
Completion and Attrition Program Data

NOTE: A-cohorts include all cohorts entering 1992-93 through 1994-95
B-cohorts include all cohorts entering 1995-96 through 1997-98
C-cohorts include all cohorts entering 1998-99 through 2000-01
In the Social Sciences (Figure 4-41), except for year four, early attrition of students with master’s degree tends to be similar for all three cohorts. Some attrition due to transfer occurs in all four years, but to a lesser extent at year four.

Figure 4-41 Components of Early Attrition in Social Sciences for Years One through Four

As Figure 4-42 shows, attrition of doctoral students who have advanced to candidacy increases each year in Humanities. Attrition due to transfer appears to occur less frequently in Humanities than in other broad fields.
As Figure 4-42 shows, attrition of doctoral students who have advanced to candidacy increases each year in Humanities. Attrition due to transfer appears to occur less frequently in Humanities than in other broad fields.

**Figure 4-42 Components of Early Attrition in Humanities for Years One through Four**

It can be observed in Figures 4-37 to 4-42 that, with a few exceptions, early attrition rates for C-cohorts are lower than for the other two cohort groups. This finding is consistent with the findings from the previous section (see Figure 4-34 to 4-36).

**Continuing, Completion, and Attrition Rates**

In the previous sections of this chapter, cumulative completion and attrition data and analyses were presented for the first ten, seven, and four years (A-, B-, and C-cohorts, respectively) after students entered their doctoral programs. However, there has been no mention of the students who were continuing their doctoral programs at the end of the same time periods. This section focuses on the rates of continuing students.
Figure 4-43 shows the percentage of A-cohort students continuing each year from the third through the tenth year after entering doctoral programs, by broad field, along with the percentage who completed and the percentage who did not complete. As might be expected, Engineering, which has the highest completion rate, also has a low percentage of the entering cohort continuing at year ten (9.7%). Mathematics & Physical Sciences, which has the highest attrition rate, has the lowest percentage of students continuing at year ten (8.3%). It is also not surprising that Humanities has the largest proportion of students continuing at year ten, because it has the lowest share of students who have completed their degrees at year ten. In general, the SSH broad fields have larger portions of entering students who are continuing at year ten than the SEM broad fields. The rate of decrease in continuing students at year ten is greatest for Humanities among the other broad fields. At year ten, the percentage of continuing students in the SEM fields starts to approach plateaus, while the percentage of continuing students in the SSH fields is still decreasing. This partially explains the differences in completion rates between SEM fields and SSH fields that was described earlier.

Figure 4-43 Cumulative Continuing, Completion, and Attrition Rates for Doctoral Students Entering from 1992-93 through 1994-95, by Broad Field and Year

Note that the proportion of continuing Ph.D. students at year ten in SSH broad fields almost doubles that in Engineering and Mathematics & Physical Sciences. If 50% of those continuing students eventually complete the Ph.D., the completion rates in SSH fields could be equal to or greater than those in Engineering and Mathematics & Physical Sciences.

The remainder of this section focuses on comparing the rates of completion, attrition, and continuing students over the time of enrollment, i.e., for A-, B-, and C-cohorts. As indicated earlier, C-cohorts have a lower rate of early attrition when compared with A-
Note that the proportion of continuing Ph.D. students at year ten in SSH broad fields almost doubles that in Engineering and Mathematics & Physical Sciences. If 50% of those continuing students eventually complete the Ph.D., the completion rates in SSH fields could be equal to or greater than those in Engineering and Mathematics & Physical Sciences.

The remainder of this section focuses on comparing the rates of completion, attrition, and continuing students over the time of enrollment, i.e., for A-, B-, and C-cohorts. As indicated earlier, C-cohorts have a lower rate of early attrition when compared with A- and B-cohorts (see Figure 4-34). As shown in Figure 4-44, C-cohorts also have a lower four-year completion rate than A- and B-cohorts. Therefore, the percentage of students who are continuing their Ph.D. programs after four years is highest for C-cohorts (see Figure 4-44). As can be seen in Figure 4-45, in all five broad fields, except Humanities\(^8\), the C-cohorts have the lowest attrition rates, the lowest completion rates, and the highest percentages of continuing students after four years of enrollment in Ph.D. programs.

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\(^8\) This trend also basically holds for Humanities, except that the completion rate of C-cohorts is slightly higher than B-cohorts for Humanities.
Figure 4-44 Overall Four-Year Cumulative Continuing, Completion, and Attrition Rates for A-, B- and C-Cohorts

As shown in Figure 4-44, C-cohorts also have a lower four-year completion rate than A- and B-cohorts. Therefore, the percentage of students who are continuing their Ph.D. programs after four years is highest for C-cohorts. As can be seen in Figure 4-45, in all five broad fields, except Humanities, the C-cohorts have the lowest attrition rates, the lowest completion rates, and the highest percentages of continuing students after four years of enrollment in Ph.D. programs.

Figure 4-45 Four-Year Cumulative Continuing, Completion, and Attrition Rates, for A-, B- and C- Cohorts, by Broad Field

1 This trend also basically holds for Humanities, except that the completion rate of C-cohorts is slightly higher than B-cohorts for Humanities.

As can be seen in Figure 4-46, this trend in declining completion and attrition rates and increasing portions of continuing students in the first four years of enrollment is basically prevalent over the nine entering cohort years, from 1992-93 through 2000-01. Of particular note is the fact that these trends are prevalent, without exception, during the last three years (i.e., C-cohort: years 1998-99, 1999-2000, and 2000-01).
As can be seen in Figure 4-46, this trend in declining completion and attrition rates and increasing portions of continuing students in the first four years of enrollment is basically prevalent over the nine entering cohort years, from 1992-93 through 2000-01. Of particular note is the fact that these trends are prevalent, without exception, during the last three years (i.e., C-cohort: years 1998-99, 1999-2000, and 2000-01).

Figure 4-46 Overall Four-Year Cumulative Continuing, Completion, and Attrition Rates by Cohort Year

There are several possible explanations for the decreasing four-year completion and attrition rates from the earlier to later cohorts (i.e., A-, B- and C-cohorts). Lower completion rates may be related to the relaxation of requirements for a master’s degree or prerequisite courses for Ph.D. admission that had persisted until the early 1990s. Without the strict requirements for a master’s degree or equivalent courses taken, it may take additional time for students to finish the prerequisite courses and then their Ph.D. degrees. This explanation can be particularly supported by the fact, shown in this study, that the first entering cohort (students who entered their programs in 1992-93) has a substantially higher four-year completion rate than the later eight entering cohorts (students who were enrolled in years 1993-94 through 2000-01). As shown in Figure
the cohort entering in 1992-93 has a completion rate as high as 13.4%, while students in the later eight cohort years have incrementally decreasing completion rates ranging from 9.0% to 6.5%.

The lower attrition rates for the C-cohorts might also be related to the improvements in financial support for students in the mid to late 1990s. Lower attrition rates could also be a result of more qualified students being admitted. However, these suggested causes are only hypotheses at this time. They will be explored in more detail later in the Ph.D. Completion Project.

Conclusions

The baseline completion and attrition data that were collected in this project allow for a thorough examination of completion and attrition patterns across broad fields, academic disciplines, student cohort sizes, and institutional types. The findings presented here suggest some potential improvements in Ph.D. completion patterns between the earliest and latest cohorts, given the lower early attrition rates in the latest cohort (C-cohorts). Even so, the attrition rates in a number of broad fields remain troublesome and deserve additional study.

At the aggregate level, the data show that nearly 57% of the doctoral candidates at the participating institutions completed their degree programs within a ten-year time span. However, Ph.D. completion rates do vary by broad field. Ten-year completion rates range from about 63% for Engineering and Life Sciences to approximately 49% for Humanities. The average completion rate in all SEM fields combined is noticeably higher than that of Social Sciences and Humanities fields, but the SSH combined completion rate appears to keep increasing even after the ten-year mark. This finding suggests that a number of students in these broad fields will continue to earn their degrees after ten years and that the differences in ultimate completion rates between the broad fields may diminish.

The Completion Project data also show that the cumulative Ph.D. completion trend in the five broad fields varies with time within ten years after enrollment. At the seven-year mark, more than half the students in Engineering and Life Sciences have earned doctorates, compared with just 29% of those in Humanities. But it should be kept in mind that 20% of doctoral students in Humanities complete their degrees between years seven and ten. Many of the students finishing after the seventh year are in SSH fields, which may indicate differences in program or field characteristics. Later publications in the Ph.D. Completion and Attrition series will examine these differences in more detail.
Another interesting finding of the Completion Project is that the Ph.D. completion rates at public universities do not differ much from those at private institutions. Public institutions seem to have slightly higher early completion rates (before year five), while private institutions have slightly higher rates thereafter. This trend, however, varies across fields. The data also show that cohort size generally does not affect completion rates, with large cohorts having slightly higher rates of completion than smaller ones in some fields but lower rates than smaller cohorts in other fields.

Attrition rates of SEM fields are clearly higher than those of SSH for all ten years after initial student entry into doctoral programs. Cumulative attrition rates in SEM fields increase quickly during the first four years after initial cohort entry but then decline. In SSH fields, the cumulative attrition rates increase more gradually. By broad field, cumulative attrition rates are highest in Mathematics & Physical Sciences but increase more consistently in Humanities. Attrition rates vary more at the program level within each broad field.

Attrition rates do not show much variation across cohort size and institution type for the combined fields. In some broad fields, cohort size and institution type appear to have a relationship to attrition rates. However, the cohort-size effect may be insignificant when controlling for disciplinary effects.

Most attrition in years one through four (early attrition) is composed of those students who leave without achieving candidacy. About half of the students who left their programs early did so without a master’s degree. As expected, attrition after achieving candidacy tends to occur after the first year. Only a small portion of early attrition is by students who transferred to another university or to another program within the same university.

C-cohorts, compared to A- and B-cohorts, consistently have lower attrition rates at year four. The lower fourth-year attrition rates in C-cohorts indicate that a lower percentage of students who were enrolled in 1998-99 through 2000-01 left their programs in the first four years than of students who were enrolled in 1992-93 through 1997-98.
The ultimate goal of the Ph.D. Completion Project is to analyze the factors that affect doctoral degree completion and attrition patterns and to develop best-practice recommendations for graduate deans, program administrators, policy makers, and the general public. Factors included in this document are broad field, discipline, institution type and cohort size. The next publication in the *Ph.D. Completion and Attrition* series will include data on student demographics (gender, race, and citizenship status). These demographic data, when aligned with the completion and attrition patterns, will be used to better inform institutional policy on doctoral student completion.

Research universities have proactively agreed to collect these data for doctoral programs before any external federal requirement to do so might emerge. The National Research Council’s Assessment of Research Doctorate Programs, which closely follow the CGS Ph.D. Completion Project’s data templates, has done much to ensure that completion-rate data will be comparable across institutions. As a result of these initiatives, completion-rate data by institution will soon be available for nearly all U.S. research doctoral programs. The availability of these data will mark an important milestone for the U.S. doctoral enterprise. With this availability, however, comes increasing scrutiny of programs that may be perceived as underperformers with respect to Ph.D. completion. When benchmarks for degree completion are applied, it will be important to consider the characteristics of each institution, each disciplinary field, and the students who enroll in them, because the meaning of “completion” and “attrition” will vary by context. Because they understand variations in such contexts, as well as the impact of employment opportunities within a given field, graduate deans and other senior graduate administrators should be leading participants in public discussions of completion rates and inquiries into which students are completing and under what conditions.
APPENDIX A
Ph.D. Completion Project – Advisory Board Members

CGS appointed an Advisory Board to guide the project. This group comprises individuals in leadership positions in academia, industry, disciplinary societies, funding agencies, and research programs on minority graduate education.

Earl Lewis (Chair)
Executive VP for Academic Affairs & Provost
Emory University

John Benbow
Senior Principal Scientist
Pfizer Global Research and Development

James Duderstadt
President Emeritus / Professor of Science & Engineering
Director of the Millennium Project
University of Michigan

Gertrude Fraser
Vice Provost for Faculty Advancement
University of Virginia

Charlotte Kuh
Deputy Executive Director
National Research Council

Joan Lorden
Provost
University of North Carolina-Charlotte

Michael Nettles
Senior Vice President, Policy Evaluation and Research Center
Educational Testing Service

Suzanne Ortega
Vice Provost and Dean, Graduate School
University of Washington

Richard Shavelson
Professor of Education and Psychology
Stanford University

Barbara Williams
Senior Director, PGRD Staffing, Diversity and HR Planning
Pfizer Global Research and Development
APPENDIX B
Ph.D. Completion Project – Phase I Institutions

Among the 46 proposals submitted by universities to participate in Phase I of the Ph.D. Completion Project (2004-2007), 21 universities were selected by an external advisory committee to receive grant funding as “Research Partners” based on the competitiveness of their proposals. The other 25 universities were included in the project as “Project Partners.” Many of these Project Partners voluntarily submitted data, and most of them actively participated in CGS sessions and events dedicated to the project and to issues of doctoral completion and attrition.

Research Partners:
Arizona State University
University of California, Los Angeles
University of Cincinnati
Cornell University
Duke University
University of Florida
University of Georgia
Howard University
University of Illinois at Urbana-Champaign
University of Louisville
University of Maryland, Baltimore County
University of Michigan
University of Missouri–Columbia
Université de Montréal
University of North Carolina at Chapel Hill
North Carolina State University
University of Notre Dame
Princeton University
Purdue University
Washington University in St. Louis
Yale University
Project Partners:
University of California, Berkeley
University of Colorado at Boulder
Florida State University *
Fordham University *
George Washington University
University of Iowa **
Jackson State University
University of Kansas
Louisiana State University
Marquette University *
McGill University (Canada)
University of Melbourne (Australia)
Michigan State University
University of Minnesota
New Mexico State University
New York University **
North Dakota State University
Pennsylvania State University *
University of Puerto Rico
University of Rhode Island
Rutgers, the State University of New Jersey **
University of Southern California
Southern Illinois University Carbondale **
Syracuse University
Western Michigan University *

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9 Nine project partners also submitted data to the baseline data analysis of our Ph.D. Completion Project, as indicated by asterisks above.

* Program and Demographic Data
** Program Data Only
### APPENDIX C

Number of Entering Students and Doctoral Programs by Broad Field and Discipline

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<th>Broad Field/Discipline</th>
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<th>Programs</th>
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## APPENDIX D

Data Templates

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![Diagram Image]
APPENDIX E
Investigation of Cohort-Size Effects vs. Disciplinary Effects on Attrition

Figure 4-25 shows that Electrical & Electronics Engineering has a very high attrition rate, 44.1% at year ten. Also, 41.2% of all large-cohort students come from Electrical & Electronics Engineering, as shown in Table E.1. This phenomenon implies that the disciplinary effect from Electrical & Electronics Engineering may partially contribute to the hierarchical distribution of attrition rates across cohort sizes. Figures E.1 and E.2 show further evidence of the influence from Electrical & Electronics Engineering on the cohort effects. When Electrical & Electronics Engineering is removed, large cohorts do not have the highest attrition rates, as is shown in Figure E.1 and E.2. Instead, medium cohorts have higher attrition rates than the large cohorts for the rest of the Engineering disciplines.

Table E.1. Student Counts by Cohort Size in Engineering for Cohorts Entering in 1992-93 though 1994-95

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Figure E.1 Cumulative Ten-Year Attrition Rates for A-Cohorts in Engineering (except Electrical & Electronics Engineering), by Cohort Sizes\textsuperscript{10} and Year

Source: Council of Graduate Schools Completion and Attrition Program Data

“Small” -- cohort size ranging from 1 to 7 students
“Medium” -- cohort size ranging from 8 to 14
“Large” -- cohort size ranging from 15 to 51
(This is the common classification of cohort size)

\textsuperscript{10} Cohort-size definition in this graph uses the shared definition for all disciplines and fields.
Figure E.2 Cumulative Ten-Year Attrition Rates for A-Cohorts in Engineering (except Electrical & Electronics Engineering), by Discipline-specific Cohort Sizes and Year

Note: A-cohorts are the cohorts entering in the academic year 1992-1993 through 1994-1995
“Small”-- cohort size ranging from 1 to 6 students
“Medium” --cohort size ranging from 7 to 13
“Large”-- cohort size ranging from 14 to 51

Source: Council of Graduate Schools
Completion and Attrition Program Data

11 Cohort size in this case is defined according to the sample distribution in this discipline.
REFERENCES


PH.D. COMPLETION AND ATTRITION

Analysis of Baseline Program Data from the Ph.D. Completion Project